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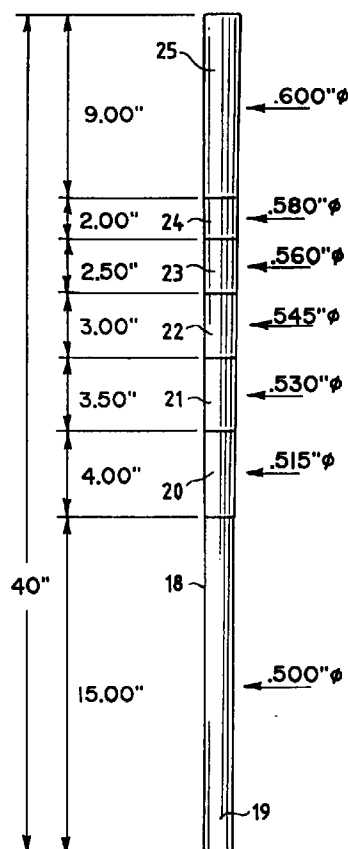
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(54) **Shaft for a golf club, set of golf clubs and method of selecting shafts**

(57) A golf club shaft (18,50,55) is provided with increased torque but substantially the same flex as prior shafts by making the outside diameter of the tip end (19,51,57) larger and varying the length of the tip end to provide the desired flex. The outside diameter of the tip end is larger than the tip ends of prior shafts to provide increased torque. The shaft can be attached to a club-head (12,27,37) by inserting the tip end over a hosel (29) or over a shaft adapter (40) which is attached to the clubhead.

FIG. 2



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Description

This invention relates to shafts for golf clubs, and, more particularly, to shafts which have reduced torque. The invention also relates to a golf club comprising this shaft and to a set of golf clubs. In the frame of the invention is a method of selecting shafts.

Torque is a measure of the ability of a golf club shaft to resist twisting about the axis of the shaft. For example, if the grip end of a golf club is clamped in a vise and the clubhead is turned relative to the shaft axis, the degree of rotation of the clubhead indicates the torque of the shaft.

Flex is another physical characteristic of a golf club shaft. Flex indicates the amount a shaft bends or "loads" during a golf swing before the shaft straightens out upon impact with a golf ball. Flex can be demonstrated by standing a shaft vertically on the floor and pushing down on the shaft. The amount of bow in the shaft indicates the flex of the shaft.

Both torque and flex affect the performance of a golf club. With respect to torque, the more a shaft is twisted as the clubhead contacts the ball, the more sidespin the ball will have. With respect to flex, if the shaft is still flexing back upon impact with the golf ball, power is lost and the shaft will feel whippy. If the shaft unloads too soon, the club has a tendency to pull the ball and the shaft will feel stiff. It is important to match the torque and flex of a shaft to optimize performance.

The aim of the invention is to lead up an improvement of a shaft, a golf club comprising a clubhead, a set of golf clubs and to provide a method of selecting shafts for a set of golf clubs. This problem is solved by the teaching according to the independent claims. Particular developments are given in the dependent claims.

The invention increases the torque of golf shafts while maintaining desired flex, weight, and balance of prior shafts. The tip end of the shaft which is attached to the clubhead is made larger than prior shafts to provide increased torque. The length of the tip end is selected to provide the desired flex.

The invention relates to a shaft -- or a golf club, or a set of golf clubs -- with this shaft having a generally cylindrical tip portion at a first end and a generally cylindrical butt portion at a second end, the tip portion having an outside diameter of greater than 0.45 inch (11.43 mm) the outside diameter of the butt portion being greater than the outside diameter of the tip portion.

The outside diameter of the tip portion of this shaft or golf club is about 0.50 inch (12.7 mm) and the length of the tip portion is within the range of about 11.5 to 20 inches (292.10 to 508 mm).

The shaft may include a plurality of generally cylindrical stepped portions of increasing outside diameters between the tip portion and the butt portion and/or a shaft adapter, which is attached to the club head and having a generally cylindrical outer end which is inserted into the tip portion of the shaft.

More advantages, characteristics and details of the invention and inherent to the same may be derived from the following description of illustrative and preferred embodiments along with the accompanying drawings, in which

Figure 1 is a perspective view of a clubhead which is equipped with a shaft in accordance with the invention;

Figure 2 is a view of a shaft for an iron club;

Figure 3 is a bottom end view of the shaft of Figure 2;

Figure 4 is a view of a shaft for a wood club;

Figure 5 is a bottom end view of the shaft of Figure 4;

Figure 6 is an elevational view of an iron clubhead which is adapted to be attached to the shaft of Figure 2;

Figure 7 is an end view of the hosel of Figure 6 taken along the line 7-7 of Figure 6;

Figure 8 is an elevational view of another iron clubhead which is adapted to be attached to the shaft of Figure 2;

Figure 9 is a side view of an adapter for attaching a shaft to the clubhead of Figure 8; and

Figure 10 illustrates a shaft formed from composite material.

Description of Specific Embodiment

Referring to Figure 1, a golf club 11 includes a clubhead 12 and a shaft 13. The shaft includes a tip end portion 14 which is attached to the clubhead and a butt end portion 15. A conventional grip 16 is mounted on the butt end portion.

Figure 2 illustrates a shaft 18 which is suitable for use with an iron club. The shaft includes a generally cylindrical tip end portion 19, a plurality of generally stepped portions 20 through 24, and a generally cylindrical butt end portion 25. The inside and outside diameters of each of the shaft portions 19-25 are substantially constant throughout the length of each portion.

The outside diameters of each of the shaft portions is indicated in Figure 2. The outside diameter of the tip portion 19 is 0.500 inch, and the outside diameter of the butt portion 25 is 0.600 inch. The outside diameters of the stepped portions 20-24 vary from 0.515 to 0.580 inch as indicated. The tolerances for the diameters are preferably ± 0.002 inch.

The outside diameter of the butt portion is conventional. However, the outside diameter of the tip portion is substantially larger than the outside diameter of the tip portion of conventional clubs, which is typically about 3/8 inch. Preferably, the outside diameter of the tip portion is greater than 0.45 inch, and more preferably at least about 0.500 inch.

Referring to Figure 3, the tip portion has an outside diameter D of 0.500 inch and an inside diameter d of

0.462 $\pm$ 0.0025 inch. The wall thickness t of the tip portion is within the range of 0.0175 to 0.020 inch. If the tolerance for the outside diameter is considered, the wall thickness is within the range of 0.0165 to 0.021 inch.

As described in U.S. Patent No. 4,555,112, increasing the outside and inside diameters of a shaft and decreasing the wall thickness can provide a higher polar moment of inertia without increasing the weight of the shaft. A shaft with a higher polar moment of inertia will twist less and have higher torque. However, the particular iron club shaft described in the patent had an outside diameter of 0.355 inch at the tip end 16 and an outside diameter of 0.400 inch at the upper end of the tapered tip portion.

The shaft 18 illustrated in Figure 2 has a length of 40 inches, which is the standard length of a shaft blank which is used for a set of irons. The length of each of the shaft portions is indicated in Figure 2. The length of the tip portion is 16 inches, and the length of the butt portion is 9 inches.

The standard shaft length for iron clubs varies from 39-1/2 inches for a No. 2 iron to 35-1/2 inches for a pitching wedge as shown in Table I.

Table I

Iron	Shaft Length (in.)
2	39-1/2
3	39
4	38-1/2
5	38
6	37-1/2
7	37
8	36-1/2
9	36
PW	35-1/2

The shaft of Figure 2 can be used for all of the irons of a set by cutting the tip portion 19 to provide the desired overall shaft length. For example, for a 2 iron, 1/2 inch is cut from the tip portion 19. For a 3 iron, 1 inch is cut from the tip portion. Each shaft would have comparable flex and would have increased torque compared to prior shafts.

The dimensions of the shaft of Figure 2 were selected to provide the same flex, kick point, and weight as a conventional True Temper Dynamic S 300 shaft with a stiff flex. The dimensions of the shaft portions can be changed to provide different flexes, kick points, etc. However, it is desirable to maintain the outside diameter of the tip portion at about 0.500 inches.

As the overall length of the shaft is reduced by reducing the length of the tip portion, the frequency of

the shaft changes. If a graduated frequency is desired for all of the clubs of a set, the weight of each of the shafts of the set should be maintained constant.

If desired a separate shaft can be used for each club of a set so that the weight or other properties of the shaft for each club can be selected as desired. For example, if it is desired to make the weight of the shaft for each club the same, then the wall thicknesses of the shafts can be varied so that the weight remains constant as the shaft length decreases. Alternatively, the lengths of the tip, butt, and stepped portions could be changed to maintain a constant weight regardless of shaft length.

Figure 6 illustrates an iron clubhead 27 which is adapted to be attached to the shaft of Figure 2. The clubhead 27 includes a conventional blade portion 28 and a hosel 29. However, because the diameter of the tip end of the shaft 18 is larger than conventional shafts, the hosel 29 is adapted to be inserted into the shaft rather than inserting the shaft into the hosel.

The hosel 29 includes a lower portion 30 which has an outside diameter substantially the same as the outside diameter of the tip portion 19 and an upper portion 31 which has an outside diameter slightly less than the inside diameter of the tip portion 19. The upper portion is provided with four longitudinal grooves 32 for receiving epoxy which is used to secure the shaft over the hosel. An annular shoulder 33 joins the upper and lower portions of the hosel.

In the particular embodiment illustrated, the outside diameter of the lower portion 30 was 1/2 inch, and the outside diameter of the upper portion 31 was 0.460 inch $\pm$ 0.000, -0.002.

The outside of the shoulder 33 had a radius R_1 of 0.010 inch, and the upper end of the hosel had a radius R_2 of 3/32 inch. The length L_1 of the upper portion 31 was 1-1/4 inch, and the length L_2 of the hosel between the top of the hosel and the radius at the heel 34 of the clubhead was 1-1/2 inch. The inside diameter of the tubular hosel was 1/4 inch. The epoxy grooves 32 were 0.020 inch wide and 0.010 inch deep.

Figures 8 and 9 illustrate an alternate structure for attaching the shaft 18 to an iron clubhead. A clubhead 37 includes a blade portion 38 and a tubular hosel 39. The hosel 39 has an outside diameter substantially the same as the outside diameter of the tip portion of the shaft. A shaft adapter 40 (Figure 9) includes a small diameter portion 41, a large diameter portion 42, and an annular shoulder 43. The diameter of the portion 41 is substantially the same as the inside diameter of the hosel 39, and the diameter of the portion 42 is substantially the same as the inside diameter of the tip portion of the shaft. The diameter of the shoulder is substantially the same as the outside diameters of the tip portion and the hosel.

The adapter portions 41 and 42 are provided with spiral epoxy grooves 44 and 45, and the adapter may also be sandblasted for better epoxy adhesion. The

adapter is advantageously formed from titanium, which is strong yet lightweight.

In one specific embodiment, the overall length of the adapter was 2-3/4 inch, and the lengths of the portions 41 and 42 were 1-1/4 inch and 1-3/8 inch, respectively.

The shaft is attached to the clubhead by coating the end portions 41 and 42 of the adaptor with epoxy and inserting them into the hosel and shaft, respectively.

Figure 4 illustrates a shaft blank 50 for a wood-type golf club. The shaft 50 is similar to the shaft 18 except that the overall length of the shaft 50 is 45 inches, and the lengths of the tip and butt portions 51 and 52 are slightly different as indicated in the drawing. The outside and inside diameters of the tip portion 51 are the same as the diameters of the tip portion 19 of the shaft 18.

A set of wood-type clubs can be formed by cutting the tip portion 51 of the shaft 50 to provide the desired overall shaft length for each club of the set. The shaft can be attached to a wood-type clubhead in the same as described for an iron clubhead. For example, metal woods are conventionally cast with a tubular hosel. The hosel can be sized to be inserted into the tip end of the shaft, or an adaptor like the adaptor of Figure 9 can be used.

The particular shafts illustrated in Figures 2 and 4 are steel shafts. However, shafts can also be made of other conventional materials such as aluminum, titanium, and composites. Composite materials include fibers such as graphite, Kevlar, boron etc. and resin. Shafts made from composite material are generally smoothly tapered from the butt end to the tip. Figure 10 illustrates a tapered shaft 55 formed from composite material. The outside diameter of the butt end 56 was 0.600 inch, and the outside diameter of the tip end 57 was 0.500 inch.

While in the foregoing specification a detailed description of a specific embodiment of the invention was set forth for the purpose of illustration, it will be understood that many of the details herein given may be varied considerably by those skilled in the art without departing from the spirit and scope of the invention.

Claims

1. A shaft for a golf club, the shaft having a generally cylindrical tip portion at a first end and a generally cylindrical butt portion at a second end, the tip portion having an outside diameter of greater than 0.45 inch (11.43 mm) the outside diameter of the butt portion being greater than the outside diameter of the tip portion.
2. A shaft of claim 1, which is part of a golf club comprising a clubhead and the shaft is attached to the clubhead, the shaft having a generally cylindrical tip portion at a first end and a generally cylindrical butt portion at a second end, the tip portion having an outside diameter of greater than 0.45 inch (11.43

mm) the outside diameter of the butt portion being greater than the outside diameter of the tip portion.

3. The shaft of claim 1 or 2 in which the outside diameter of the tip portion is about 0.50 inch (12.7 mm).
4. The shaft of one of the claims 1 to 3 in which the length of the tip portion is within the range of about 11.5 to 20 inches (292.10 to 508 mm).
5. The shaft of one of the claims 1 to 4 in which the shaft includes a plurality of generally cylindrical stepped portions of increasing outside diameters between the tip portion and the butt portion.
6. The shaft of one of the claims 2 to 5, in which a shaft adapter is attached to the clubhead and having a generally cylindrical outer end which is inserted into the tip portion of the shaft.
7. The shaft of claim 6 in which the outside diameter of the tip portion is about 0.50 inch (12.7 mm) and/or in which the inside diameter of the tip portion is within the range of about 0.460 to 0.465 inch (11,684 to 11,811 mm).
8. A set of golf clubs, each golf club in the set having a clubhead and a shaft attached to the clubhead, each club having a clubhead with a different loft angle and a shaft with a different length, the length of the shaft decreasing as the loft angle of the clubhead increase, each shaft having a generally cylindrical tip portion at a first end, a generally cylindrical butt portion at a second end, and a plurality of generally cylindrical stepped portions between the tip portion and the butt portion, the tip portion having an outside diameter of greater than 0.45 inch (11,43 mm) the outside diameter of the stepped portions increasing from the tip portion to the butt portion, the outside diameter of the butt portion being greater than the outside diameter of the stepped portions, the length of the tip portion decreasing as the loft angle of the clubhead increases, and the length of the stepped portions being substantially constant throughout the set.
9. The set of golf clubs of claim 8 in which the outside diameter of the tip portion of each shaft is about 0.50 inch (12.7 mm) and/or in which the length of the tip portion is within the range of about 11.5 to 20 inches (292,10 to 508 mm).
10. The set of golf clubs of claim 8 oder 9 in which each golf club includes a shaft adapter attached to the clubhead and having a generally cylindrical outer end which is inserted into the tip portion of the shaft.

11. The set of golf clubs of one of the claims 8 to 10 in which the inside diameter of the tip portion is within the range of about 0.460 to 0.465 inch (11,684 to 11,811 mm).

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12. A method of selecting shafts for a set of golf clubs, each golf club in the set having a clubhead and a shaft attached to the clubhead, each clubhead having a different loft angle and a shaft with a different length, the length of the shaft decreasing as the loft angle of the clubhead increases, each shaft having a generally cylindrical tip portion at a first end, a generally cylindrical butt portion at a second end, and a plurality of generally cylindrical stepped portion between the tip portion and the butt portion, the tip portion having an outside diameter of greater than 0.45 inch (11.43 mm) the outside diameter of the stepped portions increasing from the tip portion to the butt portion the outside diameter of the butt portion being greater than the outside diameter of the stepped portions, comprising varying the length of the tip portion of the shaft of each golf club so that the flex of each shaft in the set is substantially the same.

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FIG. 1

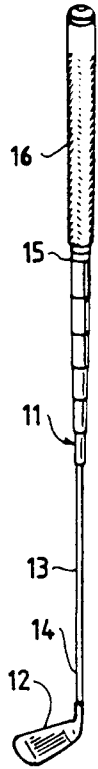


FIG. 2

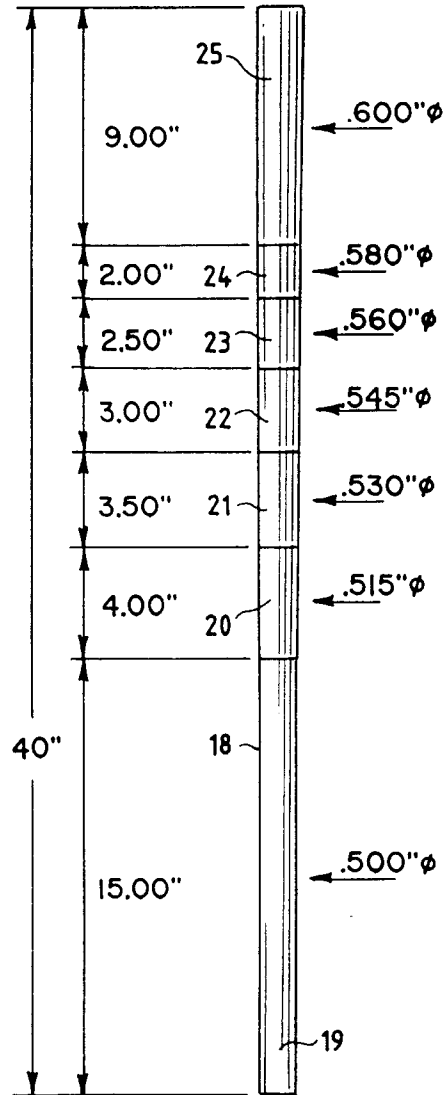


FIG. 4

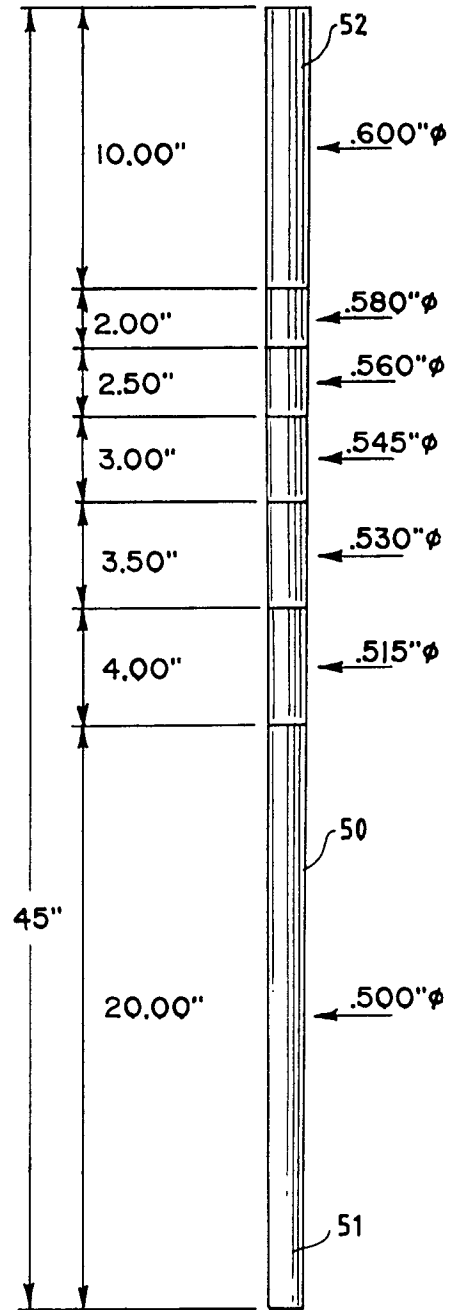


FIG. 3

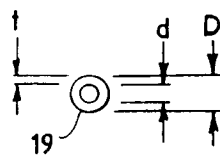
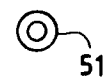
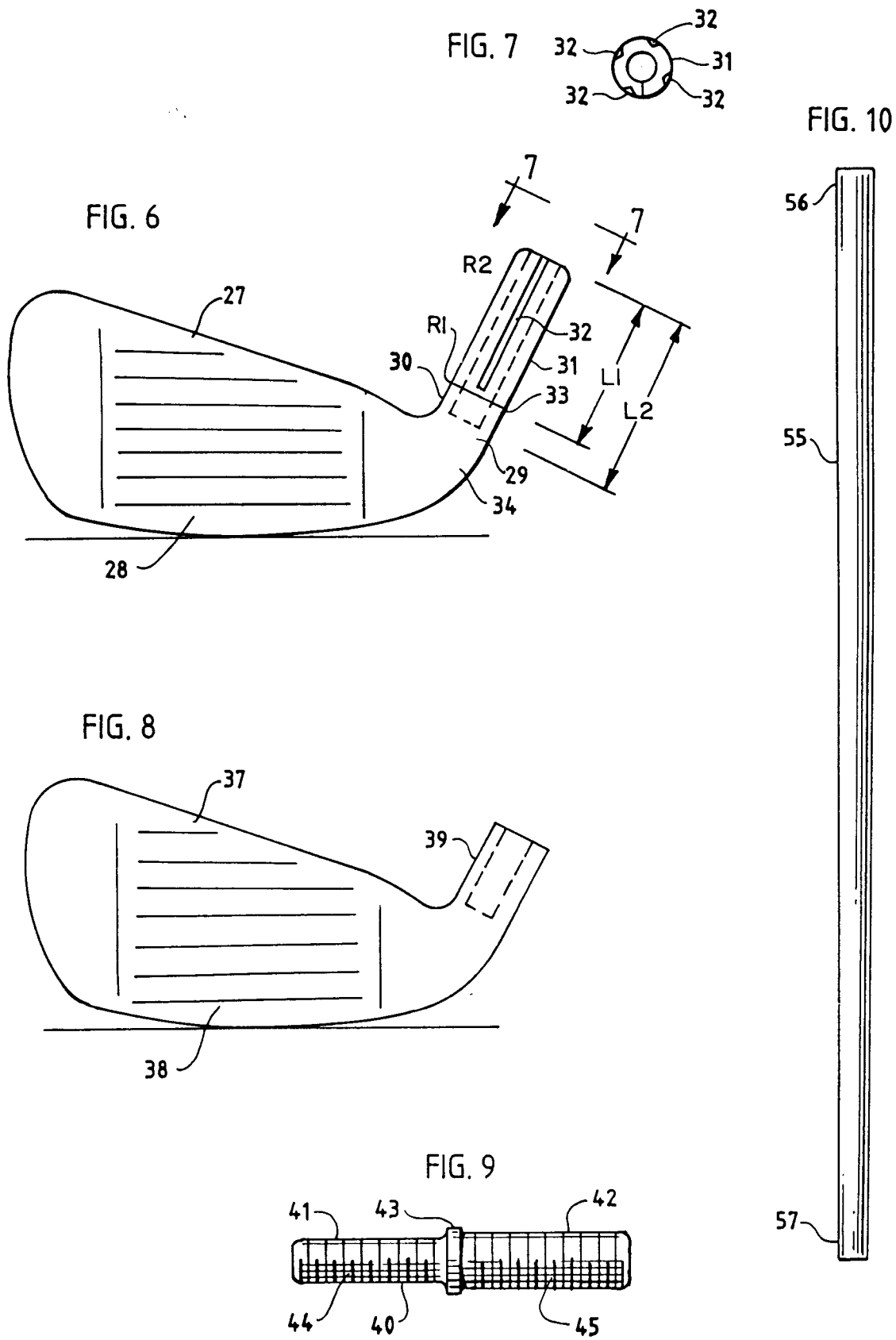


FIG. 5







European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 8435

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	US-A-4 470 600 (PARENTE ET AL.) * column 3, line 5 - column 4, line 54; figures 1-7 *	1-3,6,7 4,5, 8-10,12	A63B53/12 A63B53/10 A63B53/02
Y	GB-A-2 071 504 (TI ACCLES & POLLOCK) * the whole document *	4,5, 8-10,12	
X A	DE-A-19 61 735 (THE DUNLOP COMPANY) * page 1, last paragraph - page 2, paragraph 1 *	1-3 7-9,12	
D,A	US-A-4 555 112 (MASGHATI) * column 5, line 17 - column 7, line 43; figures 1-10 *	1,2,4,5	
A	US-A-5 093 162 (FENTON ET AL.) * column 2, line 30 - column 3, line 60; figures 1-6 *	1,2	
A	US-A-4 455 022 (WRIGHT) * column 1, line 66 - column 3, line 37; figures 1-3 *	1,2,8,12	TECHNICAL FIELDS SEARCHED (Int.Cl.6) A63B
A	GB-A-2 237 998 (TAYLOR MADE GOLF COMPANY) * page 4, last paragraph - page 5, paragraph 1; figure 1 *	6,10	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 May 1996	Examiner Williams, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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